How may a user apply the sea ice forecasts produced by this grant?

To answer this question, we will look at the evolution of the sea ice conditions north of Alaska from Sept. 2005 through Sept. 2006 as a case study, then we will discuss how this may affect various users.

In September 2005, we observed a record low in sea ice extent (concentration) over the Arctic Ocean (Fig. 1, top left). The edge of the perennial (multi-year) sea ice retreated to over 200 km north of Alaska. During the fall freeze up this area is covered with new sea ice that quickly grows to over a meter during the following months. From October 2005 – January 2006, the perennial sea ice pack drifts towards Alaska driven by strong northerly winds (note the drift of the buoys towards Alaska in Fig. 1, Dec. 2005 map). This implies heavy ridging and rafting of the new ice against the coast (note decrease in the distance of the multi-year ice from Alaska, and the dramatic decrease in area of the new ice north of Alaska from September 2005 through February 2006, i.e. the area surrounded by a thick dotted line), which agrees with observations of sea ice along the coast, e.g. upward looking sonar measurements in the area show an increase in sea ice thickness from an average of 2 m to 15 m (Humfrey Melling, pers. comm.). From February 2006 through May 2006 this new ice is estimated to drift westward along the coast to cover the north coast of Alaska with a wall of thick, ridged new ice. Farther north, the older, thicker multi-year sea ice (e.g. white area in May 2006 map), is shown to also drift westward, but even farther north of this from Alaska, a large area of younger, multi-year sea ice is estimated from the buoy drift.

Given the drift and evolution of sea ice from September 2005 through May 2006, we can thus expect that during the following summer, ice conditions will be heavy against the coast in the area of severely ridged new ice (area within thick, dotted line) and the area of older, multi-year sea ice just north of this (white sea ice), but less heavy farther north in the area of younger, multi-year sea ice (light blue sea ice). In general, the drift based estimates of sea ice conditions agree with the observed sea ice concentrations that evolved during the following summer (e.g. note agreement between areas of younger ice and sea ice concentration field in the red ovals on the July and September maps).

For navigation, we would have hopefully advised the ships (ice breakers) that wish to travel to/from the Pacific Ocean towards the Northwest Passage in the Canadian Archipelago in say July to search for an easier route farther north in the area of younger, thinner multi-year sea ice. These conditions also imply that shipping to the towns along the North Slope of Alaska may be more difficult, i.e. ships may have to plan a route farther north, then back track south through the area of severely ridged sea ice in July, or wait to see if the area opens up as it did during the following August and September of 2006. For hunters along the coast, the large expanse of severely ridged new ice may prove to be hard to traverse, but may be more ideal conditions to find seals denning within the ridges.

Using these ideas and those detailed in our proposal, we plan to provide some outlooks for sea ice conditions this summer. In May (or earlier of each year), we can provide outlooks for sea ice conditions for each of the following months based on the expected drift of sea ice, i.e. we would "advect" our estimates of sea ice conditions forward in time based on the sea ice motion climatology (and the expected drift given forecasts of the Arctic Oscillation from the NOAA Climate Prediction Center). Then each month we can update these sea ice outlooks given the observed changes in sea ice conditions.

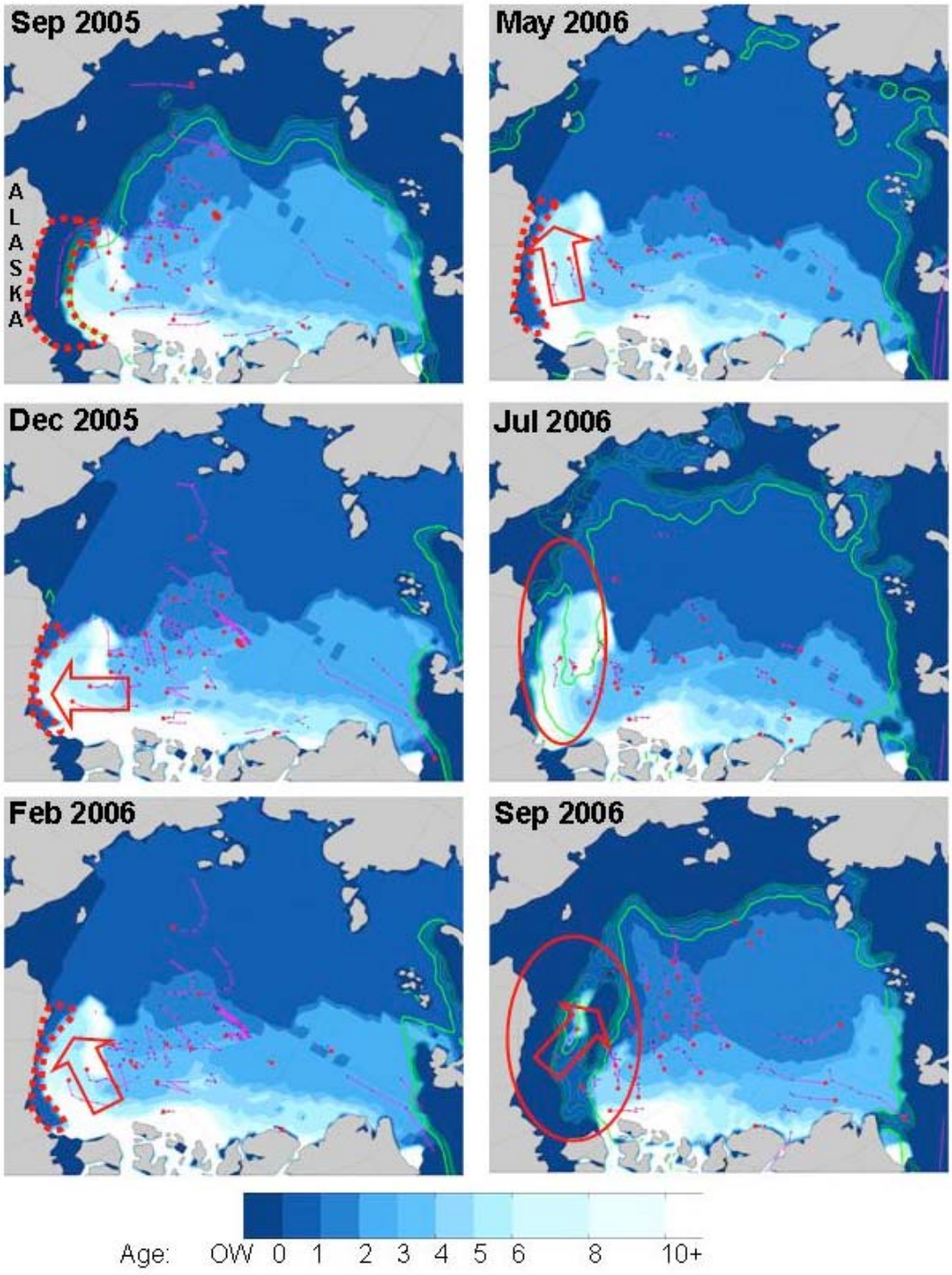

Figure 1. Evolution of sea ice conditions north of Alaska. The blue shading shows the age of sea ice estimated from buoy drift, while the green contours show sea ice concentration derived from passive microwave satellite date from 50% to 90%. The red dots show the location of drifting buoys, with a tail behind each buoy showing how the buoy drifted during the previous 6 months.